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CORONA

SUBJ: MISSION 1049, PHOTOGRAPHIC EVALUATION INTERIM REPORT (PEIR)

REF: A. [] 1457
B. [] 1502

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1. NUMERICAL SUMMARY

MSN NO. AND DATES: 1049-1, 12-18 DECEMBER 1968

1049-2, 18-23 DECEMBER 1968

LAUNCH DATE AND TIME: 12 DECEMBER 1968/2222Z

VEHICLE NUMBER: 1648

CAMERA SYSTEM: J-50

PAN CAMERA NUMBER: MASTER S/N 224, FORWARD-LOOKING

SLAVE S/N 225, AFT-LOOKING

MISSION 1049-1 S/I NO: D123/162/157

MISSION 1049-2 S/I NO: D124/165/158

RECOVERY REVS:

1049-1 REV 99, 18 DEC 1968/0122Z

1049-2 REV 179, 23 DEC 1968/2335Z

2. CAMERA SETTINGS:

FWD-LOOKING SLIT 0.165 FILTER WRITTEN 23A

AFT-LOOKING SLIT 0.135 FILTER WRITTEN 21

3. PERFORMANCE SUMMARY:

THE OVERALL IMAGE QUALITY OF MISSION 1049 IS GENERALLY OF LOWER QUALITY THAN RECENT J-1 MISSIONS. A SIGNIFICANT PERCENTAGE OF OUT-OF-FOCUS IMAGERY IS EXHIBITED IN THE FWD CAMERA RECORD, AND TO A LESSER DEGREE BY THE AFT CAMERA. HOWEVER, PORTIONS OF THE 1049-1 AFT CAMERA IMAGERY WERE AS GOOD AS PREVIOUS J-1 MISSION SAMPLES RATED AS MIP 85. [] WILL CHANGE THE MIP RATING TO 85 FROM 80 AS STATED IN THE 31 MESSAGE. THE PI SUITABILITY FOR MISSION 1049-1 WAS FAIR, ALTHOUGH THE SUITABILITY FOR 1049-2 WAS RATED AS FAIR TO POOR. THE MAGNITUDE OF THE OUT-OF-FOCUS CONDITION TENDS TO INCREASE AS THE MISSION PROGRESSES. THE MAJORITY OF MATERIAL IN 1049-1 INDICATES THAT IN GENERAL, THE AFT CAMERA IMAGE QUALITY IS SUPERIOR TO THE FWD CAMERA, WITH SIGNIFICANT DIFFERENCES NOTED NEAR THE END OF 1049-1. THE DIFFERENCE IN IMAGE QUALITY BETWEEN CAMERAS NOTED IN 1049-1 WAS NOT AS OBVIOUS IN 1049-2. THE MAJORITY OF MATERIAL FROM BOTH CAMERAS IN 1049-2 WAS OF COMPARABLE QUALITY AND CONSIDERED POORER THAN 1049-1. THE V/H PROGRAMMER FAILED DURING REV D008 AND REMAINED INOPERATIVE THROUGHOUT THE REMAINDER OF THE MISSION. AFTER THIS FAILURE, EFFECTIVE FMC CONTROL WAS MAINTAINED BY REAL TIME COMMANDS (SEE PARAGRAPH 5C). THIS FAILURE DID NOT APPEAR TO AFFECT IMAGE QUALITY. INFRARED IMAGERY WAS NOT DETECTABLE IN SPECIFIC AREAS OF PHOTOGRAPHY WHERE THE FMC MISMATCH WAS GREATEST. THERE WERE INSTANCES OF IMAGE MOTION NOTED RANDOMLY THROUGHOUT THE MISSION, HOWEVER, THESE COULD NOT BE CORRELATED WITH THE V/H FAILURE. THE OVERALL DEGRADING EFFECT ON MISSION IMAGERY PROBABLY RESULTED FROM THE HIGHER THAN DESIRED THERMAL EXCURSION IN CONJUNCTION WITH THERMAL GRADIENTS CAUSING IMAGE QUALITY CHANGES THROUGHOUT THE MISSION.

4. ANOMALIES:

A. ANOMALY: BOTH CAMERAS EXHIBITED OUT-OF-FOCUS AREAS THROUGHOUT BOTH MISSION SEGMENTS. THE GENERAL MAGNITUDE OF THE OVERALL IMAGE SOFTNESS TENDED TO INCREASE DURING THE MISSION.

CAUSE: THERE ARE SEVERAL POTENTIAL CONTRIBUTORY FACTORS TO THE FOCAL DEGRADATION. THESE INCLUDE THERMAL DISTORTION OF THE LENS CELLS AND/OR RAILS, EMULSION BUILDUP CHANGING FILM LIFE CHARACTERISTICS, AND OTHER POSSIBLE SOURCES. THE PET BELIEVES, FOR

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MISSION 1049, THAT THE THERMAL PROBLEM IS THE OVERRIDING CONSIDERATION. THE CAMERA SYSTEM AVERAGE TEMPERATURES AT LAUNCH WERE NORMAL. THE ASCENT THERMAL ENVIRONMENT WAS MORE SEVERE THAN RECENT J-1 FLIGHTS, BUT NORMAL FOR THE PARTICULAR INJECTION PROFILE. FOLLOWING THE ASCENT PHASE, THE SYSTEM TEMPERATURE INCREASED TO APPROXIMATELY 11 DEGREES FAHRENHEIT ABOVE PREDICTED LEVELS. (SEE FOLLOWING TEMPERATURE SUMMARY). THE REASONS FOR THE DIFFERENCE BETWEEN PREDICTED AND ACTUAL ORBITAL TEMPERATURES CANNOT BE COMPLETELY EXPLAINED: HOWEVER, THREE FACTORS COULD HAVE CONTRIBUTED.

(1) LESS THAN OPTIMUM, BUT ACCEPTABLE, THERMAL SURFACES-- COULD ACCOUNT FOR A TWO TO THREE DEGREE FAHRENHEIT INCREASE.

(2) WINTER SOLAR FLUX IS GREATER -- COULD ACCOUNT FOR A TWO TO THREE DEGREES FAHRENHEIT INCREASE.

(3) HIGHER ASCENT THERMAL ENVIRONMENT RESULTING FROM A LOWER INJECTION ALTITUDE -- CONTRIBUTION IS UNKNOWN. THE FOLLOWING TABLE SUMMARIZES THE ORBIT THERMAL ENVIRONMENT AS MEASURED BY T/M:

PREDICTED RANGE		THERMAL SUMMARY TEMPERATURES - DEGREE FAHRENHEIT		
TIME	PAN CAMERA	ACTUAL (AVERAGE)		SUPPLY CASSETTE
LIFT OFF	50-70	NO. 224	NO. 225	
REV 9	78-94	65	65	60
REV 25	76-92	100-104D	97-100	33
REV 57	74-90	101-105D	98-101	88
REV 89	68-83	99	99	92
REV 99	1ST RECOVERY	93	93	87
		6 DEGREES	6 DEGREES	3 DEGREES DROP
		DROP	DROP	
REV 106	67-82	35	85	82
REV 177	61-76	77	77	74
REV 179	2ND RECOVERY			

D--SOME THERMAL SENSORS OUT OF BAND - HIGH.

THE TRUE IMPACT OF THE DYNAMIC THERMAL ENVIRONMENT, IN A QUANTITATIVE SENSE, CANNOT BE EXPLICITLY DEFINED. ASSUMING DESIGN SIMILARITY BETWEEN THE LENS CONFIGURATION IN THE J-1 AND J-3 SYSTEMS, DATA CAN BE EXTRAPOLATED FROM J-3 TESTS. FLIGHT DATA DEPICTING THE TEMPERATURES OF THE LENS HAVE NOT BEEN DETERMINED FOR THE J-1 SYSTEMS, BECAUSE NO PROVISION FOR THE NECESSARY SLIP RINGS HAS BEEN MADE IN THE DESIGN.

THE TECHNICAL INFORMATION RELIED UPON IS THAT WHICH WAS DETERMINED WITH A J-3 LENS CONFIGURATION. THE COMPOSITE THERMAL SENSITIVITY CONSISTS OF THREE PARTS:

(1) EQUILIBRIUM TEMPERATURE THROUGHOUT THE LENS CELL AND CONE ASSEMBLY.

(2) TEMPERATURE GRADIENT THROUGH THE CONE AND SCAN HEAD WITH RESPECT TO THE CELL.

(3) SINUSOIDAL THERMAL ENVIRONMENT ACROSS THE BARREL WITH A PERIOD APPROXIMATING ONE AND ONE-HALF HOURS TO SIMULATE DAY/LIGHT VARIATION ON ORBIT.

ACTION:

(1) INCREASE TEST SAMPLES OF THERMAL SURFACES AND RE-EVALUATE ACCEPTANCE CRITERIA.

(2) RECOMMEND SHORTER LAUNCH WINDOW TO ACCOMMODATE THERMAL EXTREMES WITHIN MISSION DURATION.

(3) REVIEW ASCENT PROFILES AND EFFECTS ON THERMAL SURFACES FROM HIGH ASCENT TEMPERATURE.

(4) DETERMINE POSSIBILITY OF INSULATING LENS CELL.

(MONITORS:)

B. ANOMALY: MINOR, MINUS DENSITY BANDS WERE REPORTED ON MATERIAL

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FROM BOTH PAN CAMERAS.

CAUSE: SIMILAR BANDS HAVE BEEN OBSERVED ON MISSION 1046 MATERIAL, AS WELL AS FILM FROM MOST GROUND TESTS USING SO-230. THIS IS A CHARACTERISTIC OF THE FILM DURING EXTENDED INOPERATIVE PERIODS. THE BANDS ARE IMAGES OF SYSTEM FILM PATH COMPONENTS WHICH ARE FORMED AS A FUNCTION OF ENVIRONMENT, NOT BECAUSE OF A LIGHT LEAK.

ACTION: NO ACTION RECOMMENDED.

C. ANOMALY: A BAND, ONE QUARTER OF THE FORMAT WIDTH, OF SOFT IMAGERY ALONG THE OUTBOARD EDGE OF THE AFT CAMERA DURING 1049-1.

CAUSE: THE CAUSE IS UNKNOWN.

ACTION: NO ACTION IS RECOMMENDED AT THIS TIME.

D. ANOMALY: VEILING WAS NOTED ON THE NUMBER 225 PORT HORIZON CAMERA. IT WAS HEAVY AT FIRST, DIMINISHING DURING THE FIRST MISSION AND CLEARING AFTER FIVE OPERATIONS OF THE SECOND SEGMENT. THIS IS THE FIRST CASE OF PORT-SIDE VEILING ON A J-1.

CAUSE: UNKNOWN.

ACTION: NO ACTION REQUIRED.

E. CHARACTERISTIC ANOMALIES: THERE ARE CERTAIN ANOMALIES WHICH ARE CONSIDERED INHERENT TO CORONA J-1 SYSTEM OPERATION. WHILE THESE ITEMS WARRANT ATTENTION TO PREVENT FURTHER DEGRADATION, THE PET DOES NOT FEEL THAT SPECIFIC ACTION ITEMS SHOULD BE ASSIGNED. A SUMMARY OF THESE ANOMALIES AND THE DEGREE OF DEGRATION IS PRESENTED BELOW:

1. RAIL SCRATCHES FROM BOTH PAN CAMERAS APPEARED NORMAL. SCRATCHES WERE LIGHT ON THE FWD-LOOKING UNIT AND NORMAL ON THE AFT.

2. LIGHT LEAK FOGGING AND ELECTROSTATIC MARKING EXHIBITED HIGHER DENSITIES THAN USUAL BECAUSE OF THE INCREASED SENSITIVITY OF SO-230 TYPE FILM.

3. BANDING BY BOTH CAMERAS WAS CONSIDERED NORMAL FOR J-1 SYSTEM; IMAGE DEGRADATION WAS MINOR.

4. EMULSION BUILDUP ON BOTH CAMERAS RESULTED IN PROGRESSIVE OBSCURATION OF THE INBOARD FORMAT EDGES AND SHRINKAGE MARKER NOTCHES DURING THE MISSION.

5. THE TIME TRACE WAS OCCASIONALLY PARTIALLY MISSING ON THE FIRST FRAME OF A PASS.

5. COMMENTS:

A. MISSION 1049 WAS THE SECOND J-1 MISSION TO BE FLOWN WITH A FULL LOAD OF SO-230 AND WAS THE FIRST TIME THAT A FLIGHT LOAD OF THIS MATERIAL WAS PROCESSED IN THE SINGLE LEVEL, DUAL-GAMMA PROCESS. PET CONSIDERED TYPE SO-230 FILM DID NOT CONTRIBUTE TO THE LOWER PERFORMANCE OF THIS MISSION, AND IS CONSIDERED ACCEPTABLE FOR FUTURE MISSIONS. THERE ARE NO RESERVATIONS CONCERNING USE OF THIS FILM WITH CORONA SYSTEMS.

B. THE SUPPLY CASSETTE SENSORS LOCATED EXTERNAL TO THE SUPPLY SPOOLS INDICATED HIGHER THAN NORMAL TEMPERATURES. ALTHOUGH THERE IS NO SPECIFIC DATA CONCERNING VACUUM-TEMPERATURE EFFECTS ON SO-230, IT IS BELIEVED THAT THE FILM SENSITOMETRIC CHARACTERISTICS WERE NOT ALTERED BEYOND THAT NORMALLY EXPERIENCED IN CORONA MISSIONS.

C. AFTER THE FAILURE OF THE V/H PROGRAMMER, EFFECTIVE FMC WAS OBTAINED BY REAL-TIME COMMANDS. THIS REQUIRED DETERMINING THE POSITION

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IN THE SINE FUNCTION AT FAILURE AND THEN ADJUSTING THE FIXED PROGRAMMER OUTPUT BY GROUND COMMAND SO THAT THE PROGRAMMER OUTPUT WOULD PROVIDE ACCEPTABLE FMC FOR A SELECTED COVERAGE. THIS USUALLY REQUIRED AN ADJUSTMENT FOR EACH ORBIT. THE OUTPUT OF THE V/H PROGRAMMER WAS LIMITED IN THIS FAILURE MODE OF OPERATION AND PERIGEE ALTITUDE WAS INCREASED BY DMU FIRINGS SO THAT FMC REQUIREMENTS COULD BE ACHIEVED. A DETAILED DESCRIPTION OF THIS FAILURE IS BEING INCLUDED WITH THE PEIR ACTION ITEM LIST. CORRECTIVE ACTION IS BEING EVALUATED AND WILL BE INCORPORATED AS SOON AS AVAILABLE.

D. SINCE TYPE SO-230 IS FASTER THAN 3404, A REDUCTION IN SLIT WIDTH IS POSSIBLE. THE SLITS WERE REDUCED BY 2/3 STOP ON THE PREVIOUS SO-230 MISSION (1046). THIS SAME SPEED DIFFERENCE WAS USED ON MISSION 1049; HOWEVER, THE SLITS WERE WIDER ON THIS MISSION THAN WOULD BE INDICATED BY THE SPEED DIFFERENCE IN ORDER TO PRODUCE BETTER EXPOSURE AT 60 DEGREES NORTH LATITUDE. THEREFORE, THE PHOTOGRAPHY BELOW 60 DEGREES NORTH LATITUDE RECEIVED SLIGHTLY MORE EXPOSURE THAN NECESSARY FOR THIS FILM. THE USE OF THE DUAL-GAMMA PROCESS WITH GREATER EXPOSURE SCALE REDUCED THIS PROBLEM.

E. INITIALLY PLANNED FOR A 15 DAY MISSION, THE OPERATION WAS REDUCED TO 11 DAYS, BECAUSE OF VEHICLE BATTERY PACK PROBLEMS. THE PREDUCTED BATTERY PACK CAPACITY WAS REDICED AS A RESULT OF THE LOSS OF TWO BATTERIES EARLY IN THE FLIGHT.

T O P E C R E T

END OF MESSAGE